Triton Elics International

eXtended Triton Format (XTF) Rev. 14

REV	DESCRIPTION OF CHANGE	DATE	BY	ENG
X1	First Draft	01/15/2002		RLC
X2	Update References	01/30/2002	RLC	
X3	Add Reference to Read_xtf.c and demo_xtf.c	02/12/2002	RLC	
X4	Add reference to MillivoltScale.	03/29/2002	RLC	
X5	Update structure size for XTFPINGHEADER	04/09/2002	RLC	
X6	Added XTFHIGHSPEEDSENSOR structure and updated header types for XTFPINGHEADER.	05/31/2002	RLC	
X7	Added ISISFORWARDBEAMHEADER and XTFBEAMXYZA Structures.	06/03/2002		
X8	Update FileHeader's SonarType. Added XTF_BATHY_SNIPPET data format and SNP0, SNP1 structures associated with the XTF_BATHY_SNIPPET packet type. Updated description of XTFPINGCHANHEADER.	08/12/2002	RLC	
X9	Reviewed an edited for accuracy	8/20/2002	RS	RS
X10	Remove Read_XTF.c reference. Read_xtf.c is no longer available. Update information on DEMO_XTF.C and its location.	9/24/2002	RLC	RLC
X11	XTFPINGHEADER/XTFBATHHEADER, HIGHSPEEDSENSOR, XTFBEAMXYZA offset listings were incorrect,updated to display correct offsets.	10/17/2002	RLC	RLC
X12	Added XTF_SARA_CAATI_HEADER packet description Updated XTFATTITUDEDATA structure to include new fields, new packet types XTF_HEADER_KLEIN3000_DATA_PAGE, XTF_HEADER_POS_RAW_NAVIGATION	03/24/2003	RLC	RLC
X13	Added section 2.3.1, Odd-numbered sidescan sonar channels Corrected the EventNumber byte offset in the XTFPINGHEADER structure (deleted the CurrentLineID field)	04/27/2004	LCS	LCS
X14	Further update to EventNumber and explanation	9/20/2004	GVS	GVS

	NAME	DATE	DESCRIPTION	
COMPILED BY	Richard Clark	1/15/2002	XTF File Format Documentation	
ENGINEER	Liz Shaw		REV: **X13**	
ENGINEER	Geoff Shipton	9/20/04	REV: X14	

1. Introduction

1.1. Purpose

This document is intended to address file format and suggested ways for TEI engineers to process XTF files.

1.2. Definitions, abbreviations, and acronyms.

XTF	Extended Triton Format.
EOF	End of file
MRU	Motion Reference Unit
RTK	Real Time Kinematic
CTD	Conductivity Temperature Depth

1.3. References

Isis Sonar User's Manual, Volume 2, TEI, Inc 2000
Xtf.h file located in source safe xtftools project (internal reference) TEI, Inc 1998.
Xtftools workspace located in source safe under devparis\library\xtftools. (internal reference) TEI, Inc 1998.
Speed of sound in seawater at high pressures. *J. Acoust. Soc. Am.*, **62** (5), 1129-1135.). Chen Millero formula.
(C. T. Chen and F. J. Millero, 1977,
Appendix D Xtf File Format. June 1999 Isis® Sonar Users Manual, Volume 2
IsisFmt.h, Usercode.h files. Located in Isis workspace. Isis version 5.94 (internal reference), TEI, Inc 1998.

2. Overall Description

2.1. Format perspective

The XTF file format (e**X**tended **T**riton **F**ormat) was created to answer the need for saving many different types of sonar, navigation, telemetry and bathymetry information. The format can easily be extended to include new types of data that may be encountered in the future.

A sample source file, **DEMO_XTF.C,** can be found in the **DEMO_XTF.ZIP** file. **DEMO_XTF.ZIP** can be found at the following URL**, (http://www.tritonelics.com/public/download/Fileformatinformation/).** The program reads an XTF file and prints the results to your screen. . (Press CTRL+Click to access the URL.)

2.2. Methodology

An XTF file can be thought of as a "pool" of data. If you use XTF to collect data during a survey, you can add data to the file at any time without needing to synchronize your data packets. For example, bathymetry data may be logged five times per second while sonar data is being logged at 10 times per second. No storage space is wasted and no "holes" are created in the saved data stream. While processing an XTF file, the processing software can easily ignore unknown or unnecessary data packets. For example, Triton Elics's Target utility program will read an XTF file for sonar data and skip over any saved bathymetry data. When a non-sonar data packet is encountered, Target simply ignores it and reads another packet. Any software that reads XTF files should also ignore unnecessary packets because it guarantees compatibility with files that may contain new kinds of data that may be included in the future.

Some users may think that the XTF file format frequently changes. That thought comes from a basic misunderstanding of the XTF methodology. As new kinds of sensors are introduced into the marketplace, new XTF packet types are created to store the unique data produced by those sensors. Those packets may not be recognized by legacy software programs, but those programs should be written to benignly skip over unrecognized XTF packets.

Since the pool of data in an XTF file is written asynchronously, it is impossible to calculate a byte offset for a specific record in the file. However, there is a straightforward method to quickly search a file for any specific data packet. This method is described later in this appendix.

2.2.1 Note to programmers

When using the structures described in this document, note that the packing should be 1. In the Microsoft Visual C++ compiler, the statement

#pragma pack(1)

should be placed before the structure definitions and

#pragma pack()

after the definitions (or equivalent). By default, Microsoft compilers use a packing of eight, which will result in different structure alignment than described in this document.

All structures should be zero-filled before use. Unused values should remain zero.

2.3. General Description

Data stored in an XTF file uses a general message format. Each XTF file begins with a file header record and is followed by one or more data packets. The file header data is stored in the XTFFILEHEADER structure. Each XTFFILEHEADER contains room for six channels. Channel data is stored in the CHANINFO structure.

Note: A “channel” in XTF is generated from a “ping.” Basic sidescan sonars are two channels. Dual-frequency sidescan sonars are four channels. A single bathymetry system is a single channel. Speed sensors, altimeters, or any other sensor that outputs data as a single numeric value (typically over a serial port) is NOT considered a channel in XTF. This kind of numeric data is entered into the system and stored in dedicated fields within the XTF files.

The basic XTF file header record is 1024 bytes in size. It can be larger than 1024 bytes when the total number of channels to be stored in the file is greater than six. In this event, the total size of the file header record grows in increments of 1024 bytes until there is enough room to hold all of the CHANINFO structures.

All XTF data packets written by Isis are padded so that the total packet size is a multiple of 64 bytes. This is not a requirement, but doing so makes playback functions faster in Isis.

Two important elements of the file header are:

Number of sonar channels

Number of bathymetry channels

These are used to determine how many CHANINFO structures will be in the header record. The CHANINFO structures for all of the sonar channels will always precede the structures for the bathymetry channels.

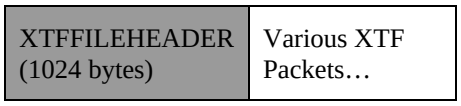
Except where otherwise documented, all values are stored using the metric system (typically meters) or degrees of angle. When using Isis to display XTF files, the user can elect to display the data in feet, and the conversion happens at display-time.

2.3.1 Odd-numbered sidescan sonar channels

For odd-numbered channels, the sample order is reversed. This is done so that the channels will display in a conventional manner in the waterfall window. When channels are selected as sub-bottom, the sample order is not reversed..

2.4. Xtf File Data Layout

Figure 1. XTF File Data Layout



The file header is the first data in the file. Depending on total number of sonar and bathy channels, CHANINFO structures may follow the file header. After the File Header and possible CHANINFO structures, data packets follow until the end of the file.

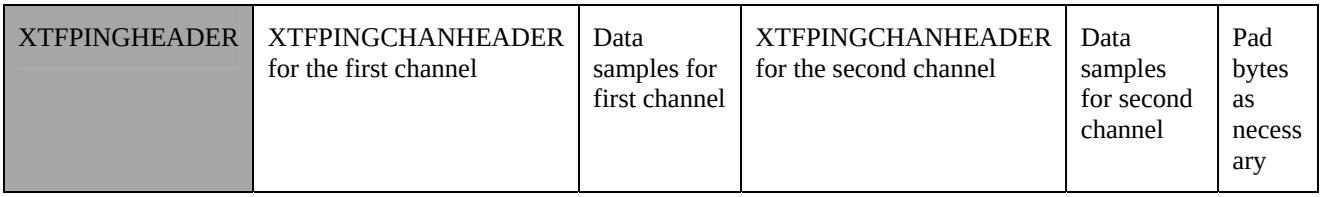
2.4.1. Xtf File Header Layout

The XTF File header structure is described in Table C. The size is 1024 bytes. If more than six channels of data are to be logged in the XTF file, then the header can grow in increments of 1024 bytes to allow for additional CHANINFO structures are required.

2.4.2. XTFPINGHEADER data layout

The value of NumChansToFollow in XTFPINGHEADER (structure defined in table H) determines the number of XTFPINGCHANHEADERs (structure defined in Table I.) that follows the XTFPINGHEADER.

Figure 2. XTF Sonar Ping Header Data Layout (example for two-channel Sidescan)

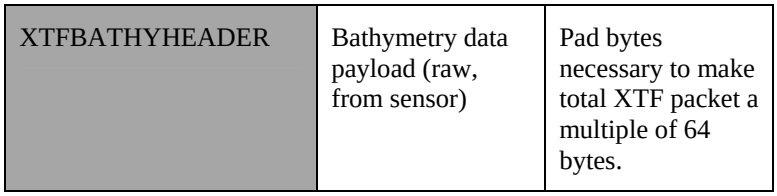


2.4.3. XTFBATHYHEADER data layout

XTFBATHHEADER structure is defined in table H. The structure is followed by a payload of bathymetry data, logged "raw" – that is, the data is unchanged and is logged exactly as received from the multibeam system. The packet is then padded with zero-filled bytes to bring the total XTF packet size to an even multiple of 64 bytes.

For details on processing the actual bathymetry data, consult the bathymetry system manufacturer.

Figure 3. XTF Bathymetry Ping Header Data Layout



2.5. Binary Data Representation

Except for some bathymetry data (which is logged "raw"), all data is written with Intel 80x86 byte ordering (LSB to MSB). If an XTF file is to be processed on a non-Intel computer such as one from Sun Microsystems, Inc., Silicon Graphics, Inc., or Apple Computer, Inc., the order of the bytes in all values must be exactly reversed. For example, a float value (4 bytes) would need to be reordered from (1,2,3,4) to (4,3,2,1) in the target machine's memory before

treating the number as a floating-point value. This effectively converts the value from little-endian (least-significant byte first) to big-endian (most-significant byte first).

3. Data Types

All sizes/formats given in this document are as follows. All data types are signed unless otherwise specified.

Table A. Data representation types for XTF headers and data packets.

Data Type	Microsoft® Data Type	Bytes	Range of Values
char	char	1	-128 to 127
short	short	2	-32,768 to 32767
int	int	*	Standard is 4 bytes but number of bytes is system dependent for a 32-bit OS. Range for a 32bit signed int (–2,147,483,648 to 2,147,483,647)
long	long	4	(–2,147,483,648 to 2,147,483,647)
float	float	4	3.4E +/- 38 (7 digits)
double	double	8	1.7E +/- 308 (15 digits)
	BYTE	1	Unsigned integer (0 to 255)
	WORD	2	Unsigned integer (0 to 65,535)
	DWORD	4	Unsigned integer (0 to 4,294,967,295)
Hex	Hexadecimal	0x0	“x” represents a value in Hexadecimal.

Descriptions for the fields are labeled with keys to indicate value status of the field. The status keys are shown in table B. below.

Table B. Field Status types.

Status	Description
M	Mandatory (must be filled in or set to a default value)
R[=value]	Recommended input (set to value if not used, or if no value given set to 0)
O[=value]	Optional (set to value if not used, if not value given set to 0)
U	Unused. Reserved for future use

3.1.1. XTFFILEHEADER Structure

Table C. XTFFILEHEADER structure.

XTFFILEHEADER			
Field	Byte Offset	Status	Comment
BYTE FileFormat	0	M	Set to 123 (0x7B)
BYTE SystemType	1	M	Set to 1
char RecordingProgramName[8]	2	M	Example: "Isis"
char RecordingProgramVersion[8]	10	M	Example: "556" for version 5.56
char SonarName[16]	18	R	Name of server used to access sonar. Example: "C31_SERV.EXE"
WORD SonarType	34	M	0 = NONE , default. 1 = JAMSTEC, Jamstec chirp 2-channel subbottom. 2 = ANALOG_C31, PC31 8-channel. 3 = SIS1000, Chirp SIS-1000 sonar. 4 = ANALOG_32CHAN, Spectrum with

			32-channel DSPlink card. 5 = KLEIN2000, Klein system 2000 with digital interface. 6 = RWS, Standard PC31 analog with special nav code. 7 = DF1000, EG&G DF1000 digital interface. 8 = SEABAT, Reson SEABAT 900x analog/serial. 9 = KLEIN595, 4-channel Klein 595, same as ANALOG_C31. 10 = EGG260, 2-channel EGG260, same as ANALOG_C31. 11 = SONATECH_DDS, Sonatech Diver Detection System on Spectrum DSP32C. 12 = ECHOSCAN, Odom EchoScanII multibeam (with simultaneous analog sidescan). 13 = ELAC, Elac multibeam system. 14 = KLEIN5000, Klein system 5000 with digital interface. 15 = Reson Seabat 8101. 16 = Imagenex model 858. 17 = USN SILOS with 3-channel analog. 18 = Sonatech Super-high res sidescan sonar. 19 = Delph AU32 Analog input (2 channel).. 20 = Generic sonar using the memory-mapped file interface. 21 = Simrad SM2000 Multibeam Echo Sounder. 22 = Standard multimedia audio. 23 = Edgetech (EG&G) ACI card for 260 sonar through PC31 card.24 = Edgetech Black Box. 25 = Fugro deeptow. 26 = C&C's Edgetech Chirp conversion program. 27 = DTI SAS Synthetic Aperture processor (memmap file). 28 = Fugro's Osiris AUV Sidescan data. 29 = Fugro's Osiris AUV Multibeam data. 30 = Geoacoustics SLS. 31 = Simrad EM2000/EM3000. 32 = Klein system 3000. 33 = SHRSSS Chirp system
char NoteString[64]	36	R	Notes as entered in the Sonar Setup dialog box
char ThisFileName[64]	100	R	Name of this file. Example:"LINE12-B.XTF"
WORD NavUnits	164	M	0=Meters (i.e., UTM) or 3=Lat/Long
WORD NumberOfSonarChannels	166	M	if > 6, header grows to 2K in size
WORD NumberOfBathymetryChannels	168	M	
BYTE NumberOfSnippetChannels	170	M	
BYTE NumberOfForwardLookArrays	171	M	
WORD NumberOfEchoStrengthChannels	172	M	
BYTE NumberOfInterferometryChannels	174	M	
BYTE Reserved1	175	U	Reserved. Set to 0.
WORD Reserved2	176	U	Reserved. Set to 0.
float ReferencePointHeight	178	O	Height of reference point above water line (m)
Navigation System Parameters			

BYTE ProjectionType[12]	182	U	Not currently used. Set to 0.
BYTE SpheriodType[10]	194	U	Not currently used. Set to 0.
long NavigationLatency	204	O	Latency of nav system in milliseconds. (Usually GPS). ISIS Note: This value is entered on the Serial port setup dialog box. When computing a position, Isis will take the time of the navigation and subtract this value.
float OriginY	208	U	Not currently used. Set to 0.
float OriginX	212	U	Not currently used. Set to 0.
float NavOffsetY	216	O	Orientation of positive Y is forward. ISIS Note: This offset is entered in the Multibeam setup dialog box
float NavOffsetX	220	O	Orientation of positive X is to starboard. ISIS Note: This offset is entered in the Multibeam setup dialog box
float NavOffsetZ	224	O	Orientation of positive Z is down. Just like depth. ISIS Note: This offset is entered in the Multibeam setup dialog box
float NavOffsetYaw	228	O	Orientation of positive yaw is turn to right. ISIS Note: This offset is entered in the Multibeam setup dialog box
float MRUOffsetY	232	O	Orientation of positive Y is forward. ISIS Note: This offset is entered in the Multibeam setup dialog box
float MRUOffsetX	236	O	Orientation of positive X is to starboard. ISIS Note: This offset is entered in the Multibeam setup dialog box
float MRUOffsetZ	240	O	Orientation of positive Z is down. Just like depth. ISIS Note: This offset is entered in the Multibeam setup dialog box
float MRUOffsetYaw	244	O	Orientation of positive yaw is turn to right. ISIS Note: This offset is entered in the Multibeam setup dialog box
float MRUOffsetPitch	248	O	Orientation of positive pitch is nose up. ISIS Note: This offset is entered in the Multibeam setup dialog box. ISIS Note: This offset is entered in the Multibeam setup dialog box
float MRUOffsetRoll	252	O	Orientation of positive roll is lean to starboard. ISIS Note: This offset is entered in the Multibeam setup dialog box
CHANINFO ChanInfo[6]	256	M	Data for each channel. The CHANINFO structures for all sidescan channels will always precede the structures for the bathymetry channels. If more than 6 structures are required, the header can grow in increments of 1024 bytes to allow for more CHANINFO structures.

The overall size is 1024 bytes.

3.1.2. CHANINFO structure

Table D. CHANINFO Structure.

CHANINFO			
Field	Byte Offset	Status	Comment

BYTE TypeOfChannel	0	M	SUBBOTTOM=0, PORT=1, STBD=2, BATHYMETRY=3
BYTE SubChannelNumber	1	O	Index for which CHANINFO structure this is.
WORD CorrectionFlags	2	O	1=sonar imagery stored as slant-range, 2=sonar imagery stored as ground range (corrected)
WORD UniPolar	4	O	0=data is polar, 1=data is unipolar
WORD BytesPerSample	6	M	1 (8-bit data) or 2 (16-bit data)
DWORD Reserved	8	U	Isis Note: Previously this was SamplesPerChannel. Isis now supports the recording of every sample per ping, which means that number of samples per channel can vary from ping to ping if the range scale changes. Because of this, the NumSamples value in the XTFPINGCHANHEADER structure (defined in Section 3.18) holds the number of samples to read for a given channel. For standard analog systems, this Reserved value is still filled in with 1024, 2048 or whatever the initial value is for SamplesPerChannel.
char ChannelName[16]	12	O	Text describing channel. i.e., "Port 500"
float VoltScale	28	O	This states how many volts are represented by a maximum sample value in the range [-5.0 to +4.9998] volts. Default is 5.0.
float Frequency	32	O	Center transmit frequency
float HorizBeamAngle	36	O	Typically 1 degree or so
float TiltAngle	40	O	Typically 30 degrees
float BeamWidth	44	O	3dB beam width, Typically 50 degrees
float OffsetX	48	O	Orientation of positive X is to starboard. Note: This offset is entered in the Multibeam setup dialog box
float OffsetY	52	O	Orientation of positive Y is forward. Note: This offset is entered in the Multibeam setup dialog box
float OffsetZ	56	O	Orientation of positive Z is down. Just like depth. Note: This offset is entered in the Multibeam setup dialog box
float OffsetYaw	60	O	Orientation of positive yaw is turn to right. If the multibeam sensor is reverse mounted (facing backwards), then OffsetYaw will be around 180 degrees. Note: This offset is entered in the Multibeam setup dialog box
float OffsetPitch	64	O	Orientation of positive pitch is nose up. Note: This offset is entered in the Multibeam setup dialog box
float OffsetRoll	68	O	Orientation of positive roll is lean to starboard. Note: This offset is entered in the Multibeam setup dialog box
WORD BeamsPerArray	72	O	For forward look only (i.e., Sonatech DDS)
char ReservedArea2[54]	74	U	Unused. Set value to 0.

Channel information structure (contained in the file header). One-time information describing each channel. This is data pertaining to each channel that will not change during the course of a run. The overall size is 128 bytes

3.1.3. Data Packet Structure

- Packet Header (usually 256 bytes). Identifies number of channels in this packet and total size of the packet. Each packet begins with a key pattern of bytes, called the "magic number", which can be used to align the data stream to the start of a packet. For each channel,
    - Channel header (optional, usually 64 bytes)
    - Channel data (optional, byte count varies)

    These data packet types currently exist for XTF files:

    Attitude (XTFATTITUDEDATA)

    Annotation (XTFNOTESHEADER)

    Bathymetry (XTFBATHHEADER)

    ELAC (XTFBATHHEADER)

    Forward Look Sonar (XTFPINGHEADER)

    Raw ASCII from serial port (XTFRAWSERIALHEADER)

    Sonar (XTFPINGHEADER)

3.1.4. XTFATTITUDEDATA structure (Attitude data packet)

Table E. XTFATTITUDEDATA Structure.

XTFATTITUDEDATA			
Field	Byte Offset	Status	Comment
WORD MagicNumber	0	M	Must be set to 0xFACE (hexadecimal value).
BYTE HeaderType	2	M	3 = XTF_HEADER_ATTITUDE (defined in Xtf.h)
BYTE SubChannelNumber	3	U	Unused. Set to 0.
WORD NumChansToFollow	4	U	Unused. Set to 0.
WORD Reserved1[2]	6	U	Unused. Set to 0.
DWORD NumBytesThisRecord	10	M	Must be 64. (Size of this packet is always 64 bytes).
DWORD Reserved2[4]	14	U	Unused. Set to 0.
float Pitch	30		Positive value is nose up
float Roll	34		Positive value is roll to starboard
float Heave	38		Positive value is sensor up. Isis Note: The TSS sends heave positive up. The MRU sends heave positive down. In order to make the data logging consistent, the sign of the MRU's heave is reversed before being stored in this field.
float Yaw	42		Positive value is turn right
DWORD TimeTag	46		System time reference in milliseconds.
float Heading	50		In degrees, as reported by MRU. TSS doesn't report heading, so when using a TSS this value will be the most recent ship gyro value as received from GPS or from any serial port using 'G' in the template.
WORD Year	54	O	Fix year.
BYTE Month	56	O	Fix month.
BYTE Day	57	O	Fix day.
BYTE Hour	58	O	Fix hour.
BYTE Minutes	59	O	Fix minute.
BYTE Seconds	60	O	Fix seconds.
WORD MicroSeconds	61	O	(0 – 9999). Fix tenths of milliseconds.
BYTE Reserved3[10]	63	U	Unused. Set to 0.

The overall size is 64 bytes.

3.1.5. XTFNOTESHEADER structure (Annotation data packet)

Table F. XTFNOTESHEADER Structure.

XTFNOTESHEADER			
Field	Byte Offset	Status	Comment
WORD MagicNumber	0	M	Must be set to 0xFACE (hexadecimal value).
BYTE HeaderType	2	M	1 = XTF_HEADER_NOTES (defined in Xtf.h)
BYTE SubChannelNumber	3	O	0=XTF notes from Param window, 1=vessel name, 2=survey area, 3=operator name.
WORD NumChansToFollow	4	U	Unused. Set to 0.
WORD Reserved[2]	6	U	Unused. Set to 0.
DWORD NumBytesThisRecord	10	M	Must be 256 (size of this packet is always 256 bytes).
WORD Year	14	M	Annotation Year
BYTE Month	16	M	Annotation month

BYTE Day	17	M	Annotation day
BYTE Hour	18	M	Annotation hour
BYTE Minute	19	M	Annotation minute
BYTE Second	20	M	Annotation second
BYTE ReservedBytes[35]	21	U	Unused. Set to 0.
char NotesText[200]	56	M	Annotation text

The overall size is 256 bytes.

3.1.6. XTFRAWSERIALHEADER (Raw Serial data packets)

Table G. XTFRAWSERIALHEADER Structure.

XTFRAWSERIALHEADER			
Field	Byte Offset	Status	Comment
WORD MagicNumber	0	M	Must be set to 0xFACE (hexadecimal value).
BYTE HeaderType	2	M	6 = XTF_HEADER_RAW_SERIAL (defined in Xtf.h)
BYTE SerialPort	3	O	Serial port used to receive this data. COM1=1, COM2=2, etc. Set to 0 when data is received by other means (i.e., memory-mapped file).
WORD NumChansToFollow	4	U	Unused. Set to 0.
WORD Reserved[2]	6	U	Unused. Set to 0.
DWORD NumBytesThisRecord	10	M	Total byte count for this ping including this ping header. Isis Note: Isis records data packets in multiples of 64 bytes. If the size of the data packet is not an exact multiple of 64 bytes, zeros are padded at the end packet and this value will be promoted to the next 64-byte granularity. In all cases, this value will be the EXACT size of this packet.
WORD Year	14	M	Year
BYTE Month	16	M	Month
BYTE Day	17	M	Day
BYTE Hour	18	M	Hour
BYTE Minute	19	M	Minute
BYTE Second	20	M	Seconds
BYTE HSeconds	21	O	Hundredths of seconds (0-99)
WORD JulianDay	22	O	Days since Jan 1
DWORD TimeTag	24	O	Millisecond timer value
WORD StringSize	28	M	Number of valid chars in RawAsciiData string
char RawAsciiData[StringSize]	30	M	Characters of Raw ASCII data

3.1.7. XTFPINGHEADER and XTFBATHHEADER (Sonar and Bathymetry data packets)

Table H. XTFPINGHEADER/ XTFBATHHEADER Structure.

XTFPINGHEADER/ XTFBATHHEADER			
Field	Byte Offset	Status	Comment
WORD MagicNumber	0	M	Must be set to 0xFACE (hexadecimal value).
BYTE HeaderType	2	M	0 = XTF_HEADER_SONAR (Sidescan data) 1 = XTF_HEADER_NOTES 2 = XTF_HEADER_BATHY (bathymetry data) 3 = XTF_HEADER_ATTITUDE (attitude packet) 4 = XTF_HEADER_FORWARD Forward look data (Sonatech) 5 = XTF_HEADER_ELAC

			Elac raw data packet. 6 = XTF_HEADER_RAW_SERIAL Raw ASCII serial port data. 7 = XTF_HEADER_EMBED_HEAD Embedded header record - num samples probably changed. 8 = XTF_HEADER_HIDDEN_SONAR Redundant (overlapping) ping from Klein 5000. 9 = XTF_HEADER_SEAVIEW_PROCESSED_BATHY Bathymetry (angles) for Seaview. 10 = XTF_HEADER_SEAVIEW_DEPTHS Bathymetry from Seaview data (depths). 11 = XTF_HEADER_RSVD_HIGHSPEED_SENSOR Used by Klein. 0=roll, 1=yaw. 12 = XTF_HEADER_ECHOSTRENGTH Elac EchoStrength (10 values). 13 = XTF_HEADER_GEOREC Used to store mosaic parameters. 14 = XTF_HEADER_KLEIN_RAW_BATHY Bathymetry data from the Klein 5000. 15 = XTF_HEADER_HIGHSPEED_SENSOR2 High speed sensor from Klein 5000. 16 = XTF_HEADER_ELAC_XSE Elac dual-head. 17 = XTF_HEADER_BATHY_XYZA 18 = XTF_HEADER_K5000_BATHY_IQ Raw IQ data from Klein 5000 server 19 = XTF_HEADER_BATHY_SNIPPET 20 = XTF_HEADER_GPS GPS Position. 21 = XTF_HEADER_STAT GPS statistics. 22 = XTF_HEADER_SINGLEBEAM 23 = XTF_HEADER_GYRO Heading/Speed Sensor. 24 = XTF_HEADER_TRACKPOINT 25 = XTF_HEADER_MULTIBEAM 50 = XTF_HEADER_TIME 60 = XTF_HEADER_BENTHOS_CAATI_SARA. Custom Benthos data. 100 = XTF_HEADER_POSITION Raw position packet - Reserved for use by Reson, Inc. RESON ONLY. 102 = XTF_HEADER_BATHY_PROC 103 = XTF_HEADER_ATTITUDE_PROC 104 = XTF_HEADER_SINGLEBEAM_PROC 105 = XTF_HEADER_AUX_PROC Aux Channel + AuxAltitude + Magnetometer. 106 = XTF_HEADER_KLEIN3000_DATA_PAGE 107 = XTF_HEADER_POS_RAW_NAVIGATION 200 = XTF_HEADER_USERDEFINED This packet type is reserved for specific applications. (defined in Xtf.h)
BYTE SubChannelNumber	3	M	If **HeaderType** is bathymetry, this indicates which head; if **HeaderType** is forward-looking sonar, and then this indicates which array. Also, Klein 5000 beam numbers are logged here.
WORD NumChansToFollow	4	M	If **HeaderType** is sonar, number of channels to follow.

WORD Reserved1[2]	6	U	Unused. Set to 0.
DWORD NumBytesThisRecord	10	M	Total byte count for this ping including this ping header. Isis Note: Isis records data packets in multiples of 64 bytes. If the size of the data packet is not an exact multiple of 64 bytes, zeros are padded at the end packet and this value will be promoted to the next 64-byte granularity. In all cases, this value will be the EXACT size of this packet.
WORD Year	14	M	Ping year
BYTE Month	16	M	Ping month
BYTE Day	17	M	Ping day
BYTE Hour	18	M	Ping hour
BYTE Minute	19	M	Ping minute
BYTE Second	20	M	Ping seconds
BYTE HSeconds	21	M	Ping hundredths of seconds (0-99)
WORD JulianDay	22	O	Julian day of a ping's occurrence.
DWORD EventNumber	24	O	Last logged event number; nav interface template token=**O NOTE:** In Isis v4.30 and earlier this field was located at byte 26-27 and was a two byte WORD. At byte 24-25 there used to be a WORD CurrentLineID. The CurrentLineID field no longer exists in the .XTF format. Therefore, to read the event number correctly an application MUST check the Isis version string starting at byte 10 of the XTFFILEHEADER structure.
DWORD PingNumber	28	M	Counts consecutively (usually from 0) and increments for each update. Isis Note: The counters are different between sonar and bathymetry updates.
float SoundVelocity	32	M	m/s, Round trip, defaults to 750. Isis Note: Can be changed on Isis menu. This value is never computed and can only be changed manually by the user. Also see ComputedSoundVelocity below.
float OceanTide	36	O	Altitude above Geoide (from RTK), if present; ELSE Ocean tide in meters; nav interface template token = **{t}** Isis Note: Can be changed by the user on the Configure menu in Isis.
DWORD Reserved2	40	U	Unused. Set to 0.
float ConductivityFreq	44	O	Conductivity frequency in Hz. nav interface template token = **Q Raw** CTD information. The Freq values are those sent up by the Seabird CTD. The Falmouth Scientific CTD sends up computed data.
float TemperatureFreq	48	O	Temperature frequency in Hz. nav interface template token = **b Raw** CTD information. The Freq values are those sent up by the Seabird CTD. The Falmouth Scientific CTD sends up computed data.
float PressureFreq	52	O	Pressure frequency in Hz. nav interface template token = **0**. Raw CTD information. The Freq values are those sent up by the Seabird CTD. The Falmouth Scientific CTD sends up computed data.
float PressureTemp	56	O	Pressure temperature (Degrees C); nav interface template token = **; Raw** CTD information. The Freq values are those sent up by the Seabird CTD. The Falmouth Scientific CTD sends up computed data.
float Conductivity	60	O	Conductivity in Siemens/m; nav interface token = **{c}**; can be computed from **Q** Computed CTD information. When using a Seabird CTD, these values are computed from the raw Freq values (above).
float WaterTemperature	64	O	Water temperature in Celsius. nav interface token = **{w}**; can be computed from **b**. Computed CTD information. When using a Seabird CTD, these values are computed

			from the raw Freq values (above).
float Pressure	68	O	Water pressure in psia; nav interface token = **{p}**; can be computed from **0**. Computed CTD information. When using a Seabird CTD, these values are computed from the raw Freq values (above).
float ComputedSoundVelocity	72	O	Meters/second computed from Conductivity, WaterTemperature, and Pressure using the Chen Millero formula (1977), formula (JASA, 62, 1129-1135)
float MagX	76	O	X-axis magnetometer data in mgauss. Nav interface template token = **e**. Sensors Information.
float MagY	80	O	Y-axis magnetometer data in mgauss. Nav interface template token = **w**. Sensors Information.
float MagZ	84	O	Z-axis magnetometer data in mgauss. Nav interface template token = **z**. Sensors Information.
float AuxVal1	88	O	Sensors Information. Nav interface template token = **1**. Auxiliary values can be used to store and display any value at the user's discretion. Not used in any calculation in Isis or Target. Isis Note: Displayed in the "Sensors" window by selecting "Window→Text→Sensors"
float AuxVal2	92	O	Sensors Information. Nav interface template token = **2**. Auxiliary values can be used to store and display any value at the user's discretion. These are not used in any calculation in Isis or Target. Isis Note: Displayed in the "Sensors" window by selecting "Window→Text→Sensors"
float AuxVal3	96	O	Sensors Information. Nav interface template token = **3**. Auxiliary values can be used to store and display any value at the user's discretion. These are not used in any calculation in Isis or Target. Isis Note: Displayed in the "Sensors" window by selecting "Window→Text→Sensors"
float AuxVal4	100	O	Sensors Information. Nav interface template token = **4**. Auxiliary values can be used to store and display any value at the user's discretion. These are not used in any calculation in Isis or Target. Isis Note: Displayed in the "Sensors" window by selecting "Window→Text→Sensors"
float AuxVal5	104	O	Sensors Information. Nav interface template token = **5**. Auxiliary values can be used to store and display any value at the user's discretion. These are not used in any calculation in Isis or Target. Isis Note: Displayed in the "Sensors" window by selecting "Window→Text→Sensors"
float AuxVal6	108	O	Sensors Information. Nav interface template token = **6**. Auxiliary values can be used to store and display any value at the user's discretion. These are not used in any calculation in Isis or Target. Isis Note: Displayed in the "Sensors" window by selecting "Window→Text→Sensors"
float SpeedLog	112	O	Sensors Information. Speed log sensor on towfish in knots; Note: This is not fish speed. Nav interface template token = **s**.
float Turbidity	116	O	Sensors Information. Turbidity sensor (0 to +5 volts) multiplied by 10000. nav interface template token = **|** (the "pipe" symbol).
float ShipSpeed	120	O	Ship Navigation information. Ship speed in knots. nav interface template token = **v**. Isis Note: These values are stored only and are not part of any equation or computation in Isis.
float ShipGyro	124	O	Ship Navigation information. Ship gyro in degrees. nav interface template token = **G**. Isis Note: This is used as the directional sensor for Multibeam Bathymetry data.

double ShipYcoordinate	128	O	Ship Navigation information. Ship latitude or northing in degrees. nav interface template token = **y**. Isis Note: These values are stored only and are not part of any equation or computation in Isis.
double ShipXcoordinate	136	O	Ship Navigation information. Ship longitude or easting in degrees. nav interface template token = **x**. Isis Note: These values are stored only and are not part of any equation or computation in Isis.
WORD ShipAltitude	144	O	Ship altitude in decimeters
WORD ShipDepth	146	O	Ship depth in decimeters.
BYTE FixTimeHour	148	R	Sensor Navigation information. Hour of most recent nav update. nav interface template token = **H**. Isis Note: The time of the nav is adjusted by the NavLatency stored in the XTF file header.
BYTE FixTimeMinute	149	R	Sensor Navigation information. Minute of most recent nav update. nav interface template token = **I**. Isis Note: The time of the nav is adjusted by the NavLatency stored in the XTF file header.
BYTE FixTimeSecond	150	R	Sensor Navigation information. Second of most recent nav update. nav interface template token = **S**. Isis Note: The time of the nav is adjusted by the NavLatency stored in the XTF file header.
BYTE FixTimeHsecond	151	R	Sensor Navigation information. Hundredth of a Second of most recent nav update. Isis Note: The time of the nav is adjusted by the NavLatency stored in the XTF file header.
float SensorSpeed	152	R	Sensor Navigation information. Speed of towfish in knots. Used for speed correction and position calculation; nav interface template token = **V**.
float KP	156	O	Sensor Navigation information. Kilometers Pipe; nav interface template token = **{K}**.
double SensorYcoordinate	160	R	Sensor Navigation information. Sensor latitude or northing; nav interface template token = **E**. Note: when NavUnits in the file header is 0, values are in meters (northings and eastings). When NavUnits is 3, values are in Lat/Long. Also see the Layback value, below.
double SensorXcoordinate	168	R	Sensor Navigation information. Sensor longitude or easting; nav interface template token = **N**. Note: when NavUnits in the file header is 0, values are in meters (northings and eastings). When NavUnits is 3, values are in Lat/Long. Also see the Layback value, below.
WORD SonarStatus	176	O	Tow Cable information. System status value, sonar dependant (displayed in Status window).
WORD RangeToFish	178	O	Slant range to sensor in decimeters; nav interface template token = **?** (question mark). Stored only – not used in any computation.
WORD BearingToFish	180	O	Bearing to towfish from ship, stored in degrees multiplied by 100; nav interface template token = **>** (greater-than sign). Stored only – not used in any computation in Isis.
WORD CableOut	182	O	Tow Cable information. Amount of cable payed out in meters; nav interface template token = **o**.
float Layback	184	O	Tow Cable information. Distance over ground from ship to fish.; nav interface template token = **l**. Isis Note: When this value is non-zero, Isis assumes that SensorYcoordinate and SensorXcoordinate need to be adjusted with the Layback. The sensor position is then computed using the current sensor heading and this layback value. The result is displayed when a position is computed in Isis.
float CableTension	188	O	Tow Cable information Cable tension from serial port. Stored only; nav interface template token = **P**

float SensorDepth	192	R	Sensor Attitude information. Distance (m) from sea surface to sensor. The deeper the sensor goes, the bigger (positive) this value becomes. nav interface template token = **0 (zero)**
float SensorPrimaryAltitude	196	R	Sensor Attitude information. Distance from towfish to the sea floor; nav interface template token = **7**. Isis Note: This is the primary altitude as tracked by the Isis bottom tracker or entered manually by the user. Although not recommended, the user can override the Isis bottom tracker by sending the primary altitude over the serial port. The user should turn the Isis bottom tracker Off when this is done.
float SensorAuxAltitude	200	O	Sensor Attitude information. Auxiliary altitude; nav interface template token = **a**. Isis Note: This is an auxiliary altitude as transmitted by an altimeter and received over a serial port. The user can switch between the Primary and Aux altitudes via the "options" button in the Isis bottom track window.
float SensorPitch	204	R	Sensor Attitude information. Pitch in degrees (positive=nose up); nav interface template token = **8**.
float SensorRoll	208	R	Sensor Attitude information. Roll in degrees (positive=roll to starboard); nav interface template token = **9**.
float SensorHeading	212	R	Sensor Attitude information. Sensor heading in degrees; nav interface template token = **h**.
float Heave	216	O	Attitude information. Sensors heave at start of ping. Positive value means sensor moved up. Note: These Pitch, Roll, Heading, Heave and Yaw values are those received closest in time to this sonar or bathymetry update. If a TSS or MRU is being used with a multibeam/bathymetry sensor, the user should use the higher-resolution attitude data found in the XTFATTITUDEDATA structures.
float Yaw	220	O	Attitude information. Sensor yaw. Positive means turn to right. Note: These Pitch, Roll, Heading, Heave and Yaw values are those received closest in time to this sonar or bathymetry update. If a TSS or MRU is being used with a multibeam/bathymetry sensor, the user should use the higher-resolution attitude data found in the XTFATTITUDEDATA structures. Since the heading information is updated in high resolution, it is not necessary to log or use Yaw in any processing. Isis does not use Yaw.
DWORD AttitudeTimeTag	224	R	Attitude information. In milliseconds - used to coordinate with millisecond time value in Attitude packets. (M)andatory when logging XTFATTITUDE packets.
float DOT	228	O	Misc. Distance Off Track
DWORD NavFixMilliseconds	232	R	Misc. millisecond clock value when nav received.
BYTE ComputerClockHour	236	O	Isis Note: The Isis computer clock time when this ping was received. May be different from ping time at start of this record if the sonar time-stamped the data and the two systems aren't synched. This time should be ignored in most cases.
BYTE ComputerClockMinute	237	O	Isis Note: see above Isis Note
BYTE ComputerClockSecond	238	O	Isis Note: see above Isis Note
BYTE ComputerClockHsec	239	O	Isis Note: see above Isis Note
short FishPositionDeltaX	240	O	Additional Tow Cable and Fish information from Trackpoint. Stored as meters multiplied by 3.0, supporting +/- 10000.0m (usually from trackpoint); nav interface template token = **{DX}**.
short FishPositionDeltaY	242	O	Additional Tow Cable and Fish information from Trackpoint. X, Y offsets can be used instead of logged

			layback.; nav interface template token = **{DY}**.
unsigned char FishPositionErrorCode	244	O	Additional Tow Cable and Fish information from Trackpoint. Error code for FishPosition delta x,y. (typically reported by Trackpoint).
BYTE ReservedSpace2[11]	245	U	Unused. Set to 0.

ISISFORWARDHEADER and ISISECHOSTRENGTHHEADER are defined as XTFPINGHEADERs. The overall size is 256 bytes

3.1.8. XTFPINGCHANHEADER structure

XTFPINGCHANHEADER is used to hold data that can be unique to each channel from ping to ping. One of these headers follows each XTFPINGHEADER, no XTFPINGCHANHEADERS follow a XTFBATHYHEADER.

Table I. XTFPINGCHANHEADER structure.

XTFPINGCHANHEADER			
Field	Byte Offset	Status	Comment
WORD ChannelNumber	0	M	Typically 0=port (low frequency) 1=stbd (low frequency) 2=port (high frequency) 3=stbd (high frequency)
WORD DownsampleMethod	2	O	2 = MAX; 4 = RMS
float SlantRange	4	M	Slant range of the data in meters
float GroundRange	8	O	Ground range of the data; in meters ($SlantRange^2$ - $Altitude^2$)
float TimeDelay	12	O	Amount of time, in seconds, to the start of recorded data. (almost always 0.0).
float TimeDuration	16	R	Amount of time, in seconds, recorded (typically SlantRange/750)
float SecondsPerPing	20	R	Amount of time, in seconds, from ping to ping. (SlantRange/750)
WORD ProcessingFlags	24	O	4 = TVG; 8 = BAC&GAC; 16 = filter, etc. (almost always zero)
WORD Frequency	26	R	Ccenter transmit frequency for this channel.
WORD InitialGainCode	28	O	Settings as transmitted by sonar
WORD GainCode	30	O	Settings as transmitted by sonar
WORD BandWidth	32	O	Settings as transmitted by sonar
DWORD ContactNumber	34	U	Contact information . Upated when contacts are saved in Target utility.
WORD ContactClassification	38	U	Contact information . Updated when contacts are saved in Target utility.
BYTE ContactSubNumber	40	U	Contact information . Udated when contacts are saved in Target utility
BYTE ContactType	41	U	Contact information . Updated when contacts are saved in

			Target utility
DWORD NumSamples	42	M	Number of samples that will follow this structure. The number of bytes will be this value multiplied by the number of bytes per sample. BytesPerSample found in CHANINFO structure (given in the file header).
WORD MillivoltScale	46	O	Maximum voltage, in mv, represented by a full-scale value in the data.If zero, then the value stored in the VoltScale should be used instead. VoltScale can be found in the XTF file header, ChanInfo structure. Note that VoltScale is specified in volts, while MillivoltScale is stored in millivolts. This provides for a range of –65,536 volts to 65,535 volts.
float ContactTimeOffTrack	48	U	Time off track to this contact (stored in milliseconds)
BYTE ContactCloseNumber	52	U	
BYTE Reserved2	53	U	Unused. Set to 0.
float FixedVSOP	54	O	This is the fixed, along-track size of each ping, stored in centimeters. On multibeam systems with zero beam spread, this value needs to be filled in to prevent Isis from calculating along-track ground coverage based on beam spread and speed over ground.
BYTE ReservedSpace[6]	58	U	Unused. Set to 0.

The overall size is 64 bytes. The number of samples following the XTFPINGCHANHEADER is defined in NumSamples.

3.1.9. XTFHIGHSPEEDSENSOR structure

Table J. XTFHIGHSPEEDSENSOR structure

XTFHIGHSPEEDSENSOR			
Field	Byte Offset	Status	Comment
WORD MagicNumber	0	M	Must be set to 0xFACE (hexadecimal value).
BYTE HeaderType	2	M	15 = XTFHIGHSPEEDSENSOR (defined in Xtf.h)
BYTE SubChannelNumber	3	M	0=altitude, 1=roll, 2=yaw
WORD NumChansToFollow	4	U	Unused. Set to 0
WORD Reserved1[2]	6	U	Unused. Set to 0.
DWORD NumBytesThisRecord	10	M	Total byte count for this ping including this ping header. Isis Note: Isis records data packets in multiples of 64 bytes. If the size of the data packet is not an exact multiple of 64 bytes, zeros are padded at the end packet and this value will be promoted to the next 64-byte granularity. In all cases, this value will be the EXACT size of this packet.
Word Year	14	M	
BYTE Month	16	M	
BYTE Day	17	M	
BYTE Hour	18	M	
BYTE Minute	19	M	
BYTE Second	20	M	
BYTE HSeconds	21	M	
DWORD NumSensorBytes	22	M	Number of bytes of sensor data following this structure.
DWORD RelativeBathyPingNum	26	M	Bathymetry ping number belonging to this sensor data.
BYTE Reserved3[34]	30	U	Unused. Set to 0.

The overall size is 64 bytes.

3.1.10. XTFBEAMXYZA structure (processed bathymetry)

Table M. XTFBEAMXYZA Structure.

XTFBEAMXYZA			
Field	Byte Offset	Status	Comment
double dPosOffsetTrX	0	M	Offset Northing from fish
double dPosOffsetTrY	8	M	Offset Easting from fish
float fDepth	16	M	Absolute Depth
double dTime	20	M	Two way travel time
BYTE usAmpl	28	M	Amplitude
BYTE ucQuality	29	M	Quality.

The overall size is 30 bytes.

3.1.11. XTF BATHY SNIPPET

Figure 4. XTF Bathy Snippet data layout

The XTF BATHY SNIPPET data starts with an XTFPINGHEADER then it is followed by SNP0, refer to table N. The number of SNP1 (refer to table O) structures to follow the SNP0 is determined by the beamcount value stored in the SNP0 structure. The entire XTF packet is padded with zero-filled bytes to make the size an even multiple of 64.

Table N. SNP0 structure (generated by Reson Seabat)

SNP0			
Field	Byte Offset	Status	Comment
unsigned long ID	0	M	Identifier code. SNP0= 0x534E5030
unsigned short HeaderSize	4	M	Header size, bytes.
unsigned short DataSize	6	M	Data size following header, bytes.
unsigned long PingNumber	8	M	Sequential ping number.
unsigned long Seconds.	12	M	Time since 00:00:00, 1-Jan-1970
unsigned long Millisec	16	M	
unsigned short Latency	20	M	Time from ping to output (milliseconds)
unsigned short SonarID[2]	22	M	Least significant four bytes of Ethernet address.
unsigned short SonarModel	26	M	Coded model number of sonar.
unsigned short Frequency	28	M	Sonar frequency (kHz).
unsigned short SSpeed	30	M	Programmed sound velocity (m/sec).
unsigned short SampleRate	32	M	A/D sample rate (samples/sec).
unsigned short PingRate	34	M	Pings per second, 0.001 Hz steps.
unsigned short Range	36	M	Range setting (meters).
unsigned short Power	38	M	Power
unsigned short Gain	40	M	(b15=auto, b14=TVG, b6..0=gain).
unsigned short PulseWidth	42	M	Transmit pulse width (microseconds).
unsigned short Spread	44	M	TVG spreading, n*log(R), 0.25dB steps.
unsigned short Absorb	46	M	TVG absorption, dB/km, 1dB steps.
unsigned short Proj	48	M	b7 = steering, b4..0 = projector type.
unsigned short ProjWidth	50	M	Transmit beam width along track, 0.1 deg steps.
unsigned short SpacingNum	52	M	Receiver beam spacing, numerator, degrees.
unsigned short SpacingDen	54	M	Receiver beam spacing, denominator.
short ProjAngle	56	M	Projector steering, degrees*PKT_STEER_RES
unsigned short MinRange	58	M	Range filter settings
unsigned short MaxRange	60	M	
unsigned short MinDepth	62	M	Depth filter settings.
unsigned short MaxDepth	64	M	Depth filter settings.
unsigned short Filters	66	M	Enabled filters: b1=depth, b0=range.
BYTE bFlags[2]	68	M	Bits 0 – 11 spare, Bits 12 – 14 snipMode, Bit 15 RollStab. Bit 0: roll stabilization enabled.
Short HeadTemp	70	M	Head temperature, 0.1C steps.
unsigned short BeamCnt	72	M	number of beams

The overall size is 74 bytes.

Table O. SNP1 structure.

SNP1			
Field	Byte Offset	Status	Comment
unsigned long ID	0	M	Identifier code. SNP1= 0x534E5031
unsigned short HeaderSize	4	M	Header size, bytes.
unsigned short DataSize	6	M	Data size following header, bytes.
unsigned long PingNumber	8	M	Sequential ping number.
unsigned short Beam	12	M	Beam number, 0..N-1.
unsigned short SnipSamples	14	M	Snippet size, samples.
unsigned short GainStart	16	M	Gain at start of snippet, 0.01 dB steps, 0=ignore.
unsigned short GainEnd	18	M	Gain at end of snippet, 0.01 dB steps, 0=ignore.
unsigned short FragOffset	20	M	Fragment offset, samples from ping.
unsigned short FragSamples	22	M	Fragment size, samples.

The overall size is 24 bytes.

3.1.12. XTF_HEADER_BENTHOS_CAATI_SARA data layout

Figure 5. BENTHOS CAATI SARA ping data layout

CAATI Packet Data

1. Use existing XTF header type 60 = XTF_HEADER_BENTHOS_CAATI_SARA.
2. Store SARA/CAATI 3D data in an XTFPINGHEADER followed by one XTFPINGCHANHEADER followed by the Benthos SARA/CAATI "PINGINFO" data. For more information on the Benthos PINGINFO structure, please contact Benthos.

XTFPINGHEADER	XTFPINGCHANHDEADER	Benthos PINGINFO structure	Benthos PINGINFO data samples

3.1.13. XTF POSRAW NAVIGATION

Table P. XTFPOSRAWNAVIGATION Structure.

XTFPOSRAWNAVIGATION			
Field	Byte Offset	Status	Comment
WORD MagicNumber	0	M	Must be set to 0xFACE (hexadecimal value).
BYTE HeaderType	2	M	107 = XTF_HEADER_POS_RAW_NAVIGATION
BYTE SubChannelNumber	3	U	Unused. Set to 0.
WORD NumChansToFollow	4	U	Unused. Set to 0.
WORD Reserved1[2]	6	U	Unused. Set to 0.
DWORD NumBytesThisRecord	10	M	Must be 64. (Size of this packet is always 64 bytes).
WORD Year	14	M	Fix year.
BYTE Month	16	M	Fix month.
BYTE Day	17	M	Fix day.
BYTE Hour	18	M	Fix hour.
BYTE Minutes	19	M	Fix minute.
BYTE Seconds	20	M	Fix seconds.
WORD MicroSeconds	21	M	(0 – 9999). Fix tenths of milliseconds.
double RawYcoordinate	23	M	Raw position from POSRAW or other time stamped nav source.
double RawXcoordinate	31	M	Raw position from POSRAW or other time stamped nav source.
double RawAltitude	39	O	Altitude, can hold RTK altitude.
float Pitch	47	O	Positive value is nose up
float Roll	51	O	Positive value is roll to starboard
float Heave	55	O	Positive value is sensor up. Isis Note: The TSS sends heave positive up. The MRU sends heave positive down. In order to make the data logging consistent, the sign of the MRU's heave is reversed before being stored in this field.
float Heading	59	O	In degrees, as reported by MRU. TSS doesn't report heading, so when using a TSS this value will be the most recent ship gyro value as received from GPS or from any serial port using 'G' in the template.
BYTE Reserved2	63	U	Unused.

The overall size is 64 bytes.

XTF File Format Usage Notes

VERSION

In order for XTF files to be read correctly in Isis, the XTFFileHeader->RecordingProgramVersion string must contain an ASCII string which represents a number >= "223".

strcpy(XTFFileHeader->RecordingProgramVersion, "223");

It's best to use "223" but you can use any other number. However, **do not** use numbers in the range of "303" to "312". There was a bug in Isis versions within this range that caused the size of each channel to be padded to a multiple of 64 bytes, rather than the size of the entire packet. Isis detects XTF files within this version range, and adapts to read these particular files correctly.

To increase the available event numbers in an .XTF the data type for EventNumber was changed from a WORD to DWORD. This change was made in Isis v3.41. To correctly read the event numbers applications should check the RecordingVersion string in the XTFFileHeader structure.

PADDING

XTF packets can be any size >= 64 bytes. The entire size of the packet must be given in bytes 10-13 of the packet. Isis is slightly more efficient if the packets are created in multiple of 64 bytes, but Isis or the XTF format does not require this. To pad an XTF packet to a multiple of 64 bytes, do the following:

a. Set the packet size to be the next greater than or even multiple of 64.
   *size = ((size+63)/64)*64*.
b. Zero-fill the unused pad bytes.

That's it. Isis will ignore the pad bytes. This works because within each XTF packet, the size of the data that is actually used is either specified explicitly or implicitly within the XTF packet itself, so extra bytes are benignly ignored.

SAMPLES PER CHANNEL

The XTF format documented before October 27, 1998 called for the number of samples per channel to be given in the XTF file header. After this date, the samples per channel has been moved to the XTFPINGCHANHEADER->NumSamples field. This allows for the number of samples to change on the fly, without having to create a new XTF file whenever the range scale changes on some sonars.

The XTFFILEHEADER->ChanInfo->Reserved field was previously the NumSamples field for the whole XTF file. For backwards compatibility, Isis does the following procedure.

a. Sets the expected number of samples per channel to the “Reserved” value in the XTF header.
b. If the RecordingProgramVersion field indicates a version >= “223”, then it looks in the channel header. If XTFPINGCHANHEADER->NumSamples is non-zero, then the expected number of samples per channel is taken from that field.

When writing XTF files, the safest practice is to

a. Put some reasonable value in the XTFFILEHEADER->ChanInfo->Reserved fields. 1024 is a good number. This does not help Isis, but there are some 3rd party XTF viewers that crash if this field is zero.
b. Set version to “223” as discussed in Version above.
c. Fill in the XTFPINGCHANHEADER->NumSamples field to the correct number of samples per channel.
d. Always zero-fill XTF packets before filling them in. Unused values in XTF files are zero-filled.